B3 ~~23~~. (Once Amended) A computer system [as recited in claim 21], comprising:

a microprocessor, said microprocessor operates in accordance with a clock signal having a controllable frequency;

a fan; and

a thermal management controller operatively connected to said microprocessor and said fan, said thermal management controller operates to thermally manage said microprocessor in accordance with one of a first cooling mode and a second cooling mode, the first cooling mode involving use of said fan for cooling said microprocessor, and the second cooling mode involving reduction in the controllable frequency of the clock signal for cooling said microprocessor,

wherein said microprocessor has a sleep mode in which the controllable frequency of the clock is substantially reduced, and

wherein said thermal management controller ensures that said fan is deactivated when said microprocessor is in the sleep mode.

2 1
~~24~~. (Once Amended) A computer system as recited in claim [21] ~~22~~, wherein, with the second cooling mode, said thermal management controller causes the controllable frequency of the clock to be successively reduced as needed to provided additional cooling.

B3 cont.

4
~~25~~. (Once Amended) A computer system [as recited in claim 21], comprising:

a microprocessor, said microprocessor operates in accordance with a clock signal having a controllable frequency;

a fan; and

a thermal management controller operatively connected to said microprocessor and said fan, said thermal management controller operates to thermally manage said microprocessor in accordance with one of a first cooling mode and a second cooling mode, the first cooling mode involving use of said fan for cooling said microprocessor, and the second cooling mode involving reduction in the controllable frequency of the clock signal for cooling said microprocessor,

wherein, with the first cooling mode, said thermal management controller causes said fan to operate at successively higher speeds as needed to provided additional cooling.

5 4
26. (Once Amended) A computer system as recited in claim [21] ~~25~~, wherein said microprocessor has a sleep mode in which the controllable frequency of the clock is substantially reduced, and

wherein said thermal management controller ensures that said fan is deactivated when said microprocessor is in the sleep mode.

B2 and. 6 4
~~27~~. (Once Amended) A computer system as recited in claim [21] ~~25~~, wherein the first cooling mode serves to operate the computer for high performance operation, and the second cooling mode serves to conserve battery energy by operating the computer with reduced performance operation.

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[28. Cancelled.]

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8 7
~~29~~. (Once Amended) A computer as recited in claim [28] ~~32~~, wherein the first cooling mode is a reduced power mode and the second cooling mode is a performance mode.

9 7 32
c ~~30~~. (Once Amended) A computer as recited in claim [28] ~~28~~, wherein said temperature sensor measures the temperature of said microprocessor.

B3 10 7 32
c Cont ~~31~~. (Once Amended) A computer as recited in claim [30] ~~28~~, wherein said temperature sensor is integral with said microprocessor.



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7 ~~32.~~ (Once Amended) A computer [as recited in claim 28], comprising:

a microprocessor that operates in accordance with a clock, the clock having a controllable frequency;

a temperature sensor that measures a temperature;

a fan; and

a thermal controller for providing thermal management of said computer, said thermal controller has a first cooling mode and a second cooling mode, the controllable frequency of the clock is reduced to regulate thermal conditions when in the first cooling mode, and said fan is activated to regulate thermal conditions when in the second cooling mode,

B3 end.

wherein when said thermal controller operates in the first cooling mode, the controlled frequency of the clock is reduced when the temperature exceeds a first temperature threshold, and

wherein when said thermal controller operates in the second cooling mode, said fan is activated when the temperature exceeds a second temperature threshold.

33. A computer as recited in claim 32, wherein said microprocessor has a sleep mode in which the controlled frequency of the clock is substantially reduced, and

wherein when said microprocessor is in the sleep mode said controller ensures that said fan is deactivated regardless of thermal conditions.

19 ~~34.~~ (Once Amended) A computer [as recited in claim 28], comprising:

a microprocessor that operates in accordance with a clock, the clock having a controllable frequency;

a temperature sensor that measures a temperature;

B4 cont.

a fan; and

a thermal controller for providing thermal management of said computer, said thermal controller has a first cooling mode and a second cooling mode, the controllable frequency of the clock is reduced to regulate thermal conditions when in



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the first cooling mode, and said fan is activated to regulate thermal conditions when in the second cooling mode,

wherein said microprocessor has a sleep mode in which the controlled frequency of the clock is substantially reduced, and

wherein said controller ensures that said fan is deactivated when said microprocessor is in the sleep mode.

20
~~35~~. (Once Amended) A computer as recited in claim [28] ~~34~~ 19, wherein when said thermal controller operates in the first cooling mode, the controllable frequency of the clock is gradually and successively reduced as needed to regulate thermal conditions.

21
~~36~~. (Once Amended) A computer as recited in claim [28] ~~34~~ 19, wherein when said thermal controller operates in the first cooling mode, the controllable frequency of the clock is dependent on the temperature measured by said temperature sensor.

22
~~37~~. (Once Amended) A computer [as recited in claim 28], comprising:

a microprocessor that operates in accordance with a clock, the clock having a controllable frequency;

a temperature sensor that measures a temperature;

a fan; and

a thermal controller for providing thermal management of said computer, said thermal controller has a first cooling mode and a second cooling mode, the controllable frequency of the clock is reduced to regulate thermal conditions when in the first cooling mode, and said fan is activated to regulate thermal conditions when in the second cooling mode,

wherein said fan is a variable-speed fan, and

wherein when said thermal controller operates in the second cooling mode, the speed of said fan is gradually increased as needed to regulate thermal conditions.

B4 cont.

~~23~~38. (Once Amended) A computer [as recited in claim 28], comprising:

a microprocessor that operates in accordance with a clock, the clock having a controllable frequency;

a temperature sensor that measures a temperature;

a fan; and

a thermal controller for providing thermal management of said computer, said thermal controller has a first cooling mode and a second cooling mode, the controllable frequency of the clock is reduced to regulate thermal conditions when in the first cooling mode, and said fan is activated to regulate thermal conditions when in the second cooling mode,

wherein said fan is a variable-speed fan, and

wherein when said thermal controller operates in the second cooling mode, the speed of said fan is dependent on the temperature measured by said temperature sensor.

12 7
~~39~~. (Once Amended) A computer as recited in claim [28] ~~32~~, wherein said computer consumes reduced energy when in the first cooling mode than when in the second cooling mode, and wherein said computer operates at higher performance when in the second cooling mode than when in the first cooling mode.

16 7
~~40~~. (Once Amended) A computer as recited in claim [28] ~~32~~, wherein in the first cooling mode cooling of said microprocessor is achieved primarily through reduction in clock frequency for said microprocessor, and wherein in the second cooling mode cooling said microprocessor is achieved primarily through use of said fan.

41. A computer as recited in claim ~~40~~, wherein, in the first cooling mode, when further cooling of said microprocessor is needed beyond that provided by the reduction in the clock frequency, then said fan is activated to provide supplemental cooling of said microprocessor.



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42. A computer as recited in claim 40, wherein, in the second cooling mode, when further cooling of said microprocessor is needed beyond that provided by said fan, then the clock frequency for said microprocessor can be reduced to provide supplemental cooling of said microprocessor.

43. Cancelled.

B5

14 ~~44~~. (Once Amended) A computer as recited in claim [43] ~~32~~ 7, wherein in the first cooling mode the reduction in the controllable frequency is the primary thermal management method, and in the second cooling mode said fan is the primary thermal management method.

45. A computer as recited in claim ~~44~~, wherein in the first cooling mode said fan is the secondary thermal management method used when further cooling is needed, and in the second cooling mode the reduction in the controllable frequency is the secondary thermal management method when further cooling is needed.

46. Cancelled.

B6

13 ~~47~~. (Once Amended) A computer as recited in claim [43] ~~32~~ 7, wherein when said thermal controller operates in the first cooling mode, the controllable frequency of the clock is gradually and successively stepwise reduced as needed to regulate thermal conditions.

48. A computer system, comprising:

a microprocessor, said microprocessor operating to perform operations in accordance with a clocking frequency;

a fan;

a temperature sensor that provides a temperature indication; and

a thermal manager operatively connected to said microprocessor and said fan, said thermal manager being configured to receive the temperature indication from said temperature sensor, and said thermal manager compares the temperature indication to first and second temperature thresholds, causes the clocking frequency for said microprocessor to be reduced to provide thermal management when the temperature indication indicates that the temperature of said microprocessor exceeds the first temperature threshold, and activates said fan when the temperature indication indicates that the temperature of said microprocessor exceeds the second temperature threshold, the second temperature threshold being greater than the first temperature threshold.

Please **ADD** new claims 49-78 as follows.

25--~~49~~. A computer system as recited in claim ~~38~~ 24,

wherein said fan is operable in a plurality of different speeds,

wherein when the temperature indication indicates that the temperature does not exceed the second temperature threshold, said fan is not activated,

wherein when the temperature indication indicates that the temperature does exceed the second temperature threshold, said fan is activated and the speed of said fan is dependent upon the extent that the temperature of said microprocessor exceeds the second temperature threshold, and

wherein pulse width modulation is used to control the speed of said fan.

~~50~~ 30. A computer system as recited in claim ~~48~~ 24, wherein said computer system further comprises:

an activity detector operatively connected to said microprocessor, said activity detector determines an activity level of said microprocessor, and

wherein the speed of said fan is controlled based on the temperature of said microprocessor and the activity level.

31 ~~51~~. A computer system as recited in claim ~~50~~ 30,

wherein said thermal manager is operatively connected to said activity detector, and

wherein when said activity detector detects that the activity level is low, said thermal manager causes the clocking frequency to be substantially reduced such that said fan need not be activated.

32 ~~52~~. A computer system as recited in claim ~~48~~ 24, wherein said thermal controller manages the temperature of said microprocessor to advert its overheating in an energy efficient manner by avoiding the use of said fan at a first stage and instead improving thermal conditions by sacrificing some performance of said microprocessor by lowering the clocking frequency.

33 ~~53~~. A computer system as recited in claim ~~52~~ 32, wherein in a second stage said fan is also used to improve the thermal conditions when the lowering of the clocking frequency in the first stage is unable to stabilize the thermal conditions.

B4 cont.

35 ~~54~~. A computer system as recited in claim ~~53~~ 33, wherein in the first stage a plurality of respectively lower clocking frequencies can be used to attempt to stabilize the thermal conditions.

36 ~~55~~. A computer system as recited in claim ~~54~~ 35, wherein in the second stage a plurality of respectively greater speeds for said fan can be used to attempt to stabilize the thermal conditions.

34 ~~56~~. A computer system as recited in claim ~~53~~ 33, wherein in the second stage a plurality of respectively greater speeds for said fan can be used to attempt to stabilize the thermal conditions.

26 57. A computer system as recited in claim 24, wherein said thermal controller minimizes the use of said fan so as to minimize power consumption.

27 58. A computer system as recited in claim 24,

wherein said fan is operable in a plurality of different speeds, and

wherein when the temperature indication indicates that the temperature of said microprocessor does not exceed the second temperature threshold, said fan is not activated.

28 59. A computer system as recited in claim 24, wherein said thermal manager deactivates the fan when said microprocessor enters a reduced power mode.

29 60. A computer system as recited in claim 24, wherein said thermal manager deactivates the fan when said microprocessor enters a sleep mode.

B1 Cont. 37 61. A computer system, comprising:

a microprocessor, said microprocessor operating to perform operations in accordance with a clocking frequency;

a fan;

a temperature sensor that provides a temperature indication; and

a thermal manager operatively connected to said microprocessor and said fan, said thermal manager being configured to receive the temperature indication from said temperature sensor, and said thermal manager compares the temperature indication to first and second temperature thresholds, activates said fan when the temperature indication indicates that the temperature of said microprocessor exceeds the first temperature threshold, and causes the clocking frequency for said microprocessor to be reduced to provide thermal management when the temperature indication indicates that the temperature of said microprocessor exceeds the second



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temperature threshold, the second temperature threshold being greater than the first temperature threshold.

41 37
62. A computer system as recited in claim ~~61~~, wherein said computer system further comprises:

an activity detector operatively connected to said microprocessor, said activity detector determines an activity level of said microprocessor, and

wherein the speed of said fan is controlled based on the temperature of said microprocessor and the activity level.

42 41
~~63~~. A computer system as recited in claim ~~62~~,

wherein said thermal manager is operatively connected to said activity detector, and

wherein when said activity detector detects that the activity level is low, said thermal manager causes the clocking frequency to be substantially reduced.

B7 Cont.

43 37
~~64~~. A computer system as recited in claim ~~61~~, wherein said thermal controller manages the temperature of said microprocessor to advert its overheating in an energy efficient manner by using use of said fan at a first stage to improve thermal conditions without sacrificing performance of said microprocessor by lowering the clocking frequency.

44 43
~~65~~. A computer system as recited in claim ~~64~~, wherein in the first stage a plurality of respectively greater speeds for said fan can be used to attempt to stabilize the thermal conditions.

45 43
~~66~~. A computer system as recited in claim ~~64~~, wherein in the second stage a plurality of respectively lower clocking frequencies can be used to attempt to stabilize the thermal conditions.

38 ~~67~~. A computer system as recited in claim 37 ~~61~~,

wherein said fan is operable in a plurality of different speeds, and

wherein when the temperature indication indicates that the temperature does not exceed the first temperature threshold, said fan is not activated.

39 ~~68~~. A computer system as recited in claim 37 ~~61~~, wherein said thermal manager deactivates the fan when said microprocessor enters a reduced power mode.

40 ~~69~~. A computer system as recited in claim 37 ~~61~~, wherein said thermal manager deactivates the fan when said microprocessor enters a sleep mode.

46 ~~70~~. A computing apparatus, comprising:

a processing unit, said processing unit executes instructions in accordance with a clock signal having a clock frequency;

an activity detector that monitors activity of said processing unit; and

a clock control unit operatively connected to said processing unit and said activity detector, said clock control unit operates to alter the clock frequency of the clock signal in a gradual and dynamic manner based on the activity of said processing unit as monitored by said activity detector.

47 ~~71~~. A computing apparatus as recited in claim 46 ~~70~~, wherein said computing apparatus is a microprocessor.

48 ~~72~~. A computing apparatus as recited in claim 46 ~~70~~, wherein said clock control unit operates to reduce the clock frequency of the clock signal to reduce power consumption by said processing unit when the activity of said processing unit is low.

49 ~~73.~~ A computing apparatus as recited in claim ~~70~~ 46, wherein said computing apparatus further comprises:

a thermal sensor for monitoring temperature of said processing unit.

50 ~~74.~~ A computing apparatus as recited in claim ~~73~~ 49, wherein said clock control unit operates to alter the clock frequency of the clock signal in a gradual and dynamic manner based on the activity of said processing unit as monitored by said activity detector and the temperature of said processing unit as monitored by said thermal sensor.

51 ~~75.~~ A computing apparatus as recited in claim ~~73~~ 49, wherein said clock control unit operates to reduce the clock frequency of the clock signal to reduce power consumption by said processing unit when the activity of said processing unit is low.

52 ~~76.~~ A computing apparatus as recited in claim ~~75~~ 51, wherein said clock control unit further operates to alter the clock frequency of the clock signal to reduce power consumption by said processing unit when the temperature of said processing unit exceeds a threshold temperature.

B7 cont.

53 ~~77.~~ A computing apparatus as recited in claim ~~73~~ 49,

wherein said clock control unit operates to reduce the clock frequency of the clock signal to a lower clock frequency when the activity of said processing unit is low, thereby reducing power consumption by said processing unit when the activity of said processing unit is low,

wherein said clock control unit operates to increase the clock frequency of the clock signal to a higher clock frequency when the activity of said processing unit is high, thereby increasing processing capabilities by said processing unit, and

wherein said clock control unit further operates to alter the clock frequency of the clock signal to limit the higher clock frequency when the temperature of said processing unit exceeds a first threshold temperature.

54 78. A computing apparatus as recited in claim 53, wherein, when said clock control unit is limiting the higher clock frequency because the temperature of said processing unit previously exceeded the first threshold temperature, said clock control unit further operates to release the limit to the higher clock frequency of the clock signal when the temperature of said processing unit falls below a second threshold temperature, the second threshold temperature being below the first threshold temperature.--

B1 end.

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**IN THE ABSTRACT:**

Please delete the abstract at Page 25, lines 1-12, and insert the following therefor:

> --Improved approaches to providing thermal and power management for a computing device are disclosed. These approaches facilitate intelligent control of a processor's clock frequency and/or a fan's speed so as to provide thermal and/or power management for the computing device. --

*[REPLACEMENT ABSTRACT PAGE ATTACHED.]*

# REMARKS

In the Office Action, the Examiner rejected claim 48 under 35 USC §101; rejected claims 21-47 under the judicially created doctrine of double patenting; and rejected claims 21, 24, 27-31, 35, 36 and 39-47 under 35 USC §103(a). These rejections are fully traversed below.

Claims 22-27, 29-32, 34-40, and 47 have been amended to further clarify the subject matter regarded as the invention. In addition, claims 21, 28, 43 and 46 have been canceled from the application, and new claims 49-78 have been added to the application. Thus, claims 22-27, 29-42, 44-45 and 47-78 are currently pending. In addition, modifications to the specification and the title has been made.

Reconsideration of the application is respectfully requested based on the following remarks.



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